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Biochemical Genetic Stock Identification of Chum Salmon in Southern British Columbia 1990

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April 1991

Canadian Data Report of
Fisheries and Aquatic Sciences No. 841

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Cat. No. FS 97-13/841E ISSN 0706-6465

Correction citation for this publication:

Hop Wo, L., A.P. Gould and W.L. Luedke. 1991. Biochemical Genetic Stock Identification of Chum Salmon in Southern British Columbia 1990. Can. Data Rep. Fish. Aquat. Sci. No. 841: 16p.

TABLE OF CONTENTS

Page

ABSTRACT vi

INTRODUCTION 1

METHOD
1) Collection 1
2) Analysis 3

RESULTS 3

ACKNOWLEDGEMENTS 4

LITERATURE CITED 4

List of Tables

		Page
Table 1	Stock Composition Results from Johnstone Strait (pooled) Test Fishing	5
Table 2	Stock Composition Results from Johnstone Strait Commercial Seine Fishing	6
Table 3	Stock Composition Results from Mid Vancouver Island Gillnet Fishing	7
Table 4	Stock Composition Results from Cowichan Gillnet Fishing	8
Table 5	Stock Composition Results from Nitinat Commercial Gillnet and Test Fishing	9

List of Figures

Page

Fig. 1 Regions of Chum Sampling in 1990:
(A) Johnstone Strait, (B) Mid Vancouver Island,
(C) Cowichan, and (D) Nitinat 10

ABSTRACT

Hop Wo, L., A.P. Gould and W.H. Luedke. 1991. Biochemical Genetic Stock Identification of Chum Salmon in Southern British Columbia 1990. Can. Data. Rep. Fish. Aquat. Sci. No. 841: 16p.

Genetic stock identification (GSI) is used by the Department of Fisheries and Oceans in estimating chum stock composition. In 1990 approximately 7,200 fish were analyzed from four fishing areas (Johnstone Strait, Mid Vancouver Island, Cowichan and Nitinat). Stock composition results are presented.

Key words: chum salmon, genetic stock identification, stock composition, fishery management, Southern British Columbia.

RÉSUMÉ

Hop Wo, L., A.P. Gould et W.H. Luedke. 1991. Biochemical Genetic Stock Identification of Chum Salmon in Southern British Columbia 1990. Can. Data. Rep. Fish. Aquat. Sci. No. 841: 16p.

L'identification génétique des stocks (GSI) est utilisée par la ministère des Pêches et des Océans dans l'estimation de la composition des stocks de saumon kéta. En 1990, environ 7,200 poissions de quatre secteurs de pêches (détroit de Johnstone, partie centrale de l'île de Vancouver, Cowichan et Nitinat) ont été analysés. Les résultats concernant la composition des stocks sont présentés.

INTRODUCTION

Genetic stock identification (GSI) has occurred in Canadian chum fisheries since 1981 (Beacham et al. 1985). More recently (GSI) programs have established stock composition for every major chum fishery in Southern British Columbia. GSI results provide fisheries staff with stock identification information needed to effectively manage commercial fisheries. In addition, this information provides estimates of harvest by country, which are used in implementing the terms of the Pacific Salmon Treaty.

For Canadian commercial fisheries, GSI results have provided information on migration routes and timing as well as assisted in stock abundance estimates. This information is a vital component in the planning of expected fisheries. During the season, weekly results provide managers with an indication of chum run activity. After final analysis are complete, GSI results are used to estimate catch interceptions, which are required for stock assessment and Pacific Treaty obligations. This annual report (fifth of a series) includes a description of GSI sampling procedures and results for the 1990 fishing season.

METHOD

(1) Collection

In 1990, a total of 7,198 fish were sampled from four chum fishing areas in Southern British Columbia. Sampling occurred over a period of three months from early September to November. The samples were collected from two commercial gear types (gillnet and seine), and sampled from either commercial fishing boats, fish processing plants, or Department of Fisheries and Oceans (DFO) chartered fishing vessels.

Briefly, samples collected consisted of heart, liver, and muscle tissues from freshly caught adult chum salmon. The individually packaged tissues were then frozen to help prevent protein degeneration. Protein analysis was provided by a consultant, using the horizontal starch gel technique described by Utter et al. (1974).

Chum salmon were sampled in 1990 from the following four fishing areas (Fig. 1): Johnstone Strait (Area 12 and 13); Mid Vancouver Island (Area 14); Cowichan (Area 18) and Nitinat (Area 21). These samples were taken in order to determine the stock composition of commercial fisheries. In general, sample sizes of approximately 150-200 chum were obtained on a weekly or per fishing area basis, except for commercial fisheries in Johnstone Strait, where 600-1000 samples were collected.

The Johnstone Strait (Area 12) test fishery sampling program was conducted aboard two chartered seine vessels. Tissue samples were collected each week in conjunction with stock abundance testing at predetermined sites as described in Vreeling et al. (1987). The two seine vessels commenced sampling early in September and continued until early November. A total of 2,537 samples were collected from both vessels over a 9 week period. Each vessel collected approximately 150 chum samples per week.

In addition to test fishery samples a program was initiated to determine stock composition of the Johnstone Strait commercial fisheries. Each commercial fishery was sampled at three or more landing sites. At each landing site, approximately 200 fish were randomly sampled from selected seine vessels. Sampling was stratified by Statistical Areas, based on the proportion of total estimated catch from each area (Area 12 and 13). Samples were then frozen and analyzed after the season.

A total of three commercial fisheries were sampled. The first fishery occurred on September 20. A total of 999 chum samples were collected from 5 different landing sites. Three sample groups of approximately 200 fish each were collected in Vancouver and contained a stratified sample mixture of Areas 12 and 13 caught fish (25% and 75% respectively). The fourth sample group was collected from Port Hardy and contained only Area 12 fish, while the fifth sample was collected from Campbell River and consisted exclusively of Area 13 fish. The second Johnstone Strait fishery occurred on October 11. Three landing sites were sampled (Vancouver) for a total of 598 fish. The stratified samples consisted of 50% from Area 12 and 50% from Area 13. The final commercial fishery occurred on October 22. A total of 601 fish were sampled from three Vancouver landing sites. This sample consisted of 25% from Area 12 and 75% from Area 13. A total of 2,198 samples were collected from three commercial fisheries occurring Johnstone Strait.

Note that sampling later in the season incorporated a technique of muscle tissue coring. This technique involved making a small incision posterior to the fish operculum. The coring instrument (hollow tube, 10 cm length x 0.5 cm diameter) is then inserted and rotated to cut a tissue segment. The coring technique allows extraction of muscle tissue while causing minimum visible damage to the marketable fish.

The Mid Vancouver Island (Area 14) sampling program occurred during or immediately after each commercial gillnet fishery, aboard packing vessels. Three separate sub areas were sampled within each fishery. The target per sub area was 150 samples, however, some sampling was limited due to availability of catch. Samples were collected from three fisheries which occurred during October 16-17; 23-24; and 30-31. A total of 1,331 chum samples were obtained from the Mid Vancouver Island area fisheries.

Chum fisheries frequently occur in discreet terminal areas such as Cowichan (Area 18). This year three commercial gillnet fisheries occurred in this area of which only the first fishery was sampled for GSI. A total of 126 fish were sampled from this fishery which occurred during November 6-7. Samples were collected during and immediately after the fishery aboard packing vessels situated on the fishing grounds. The latter two fisheries were not sampled due to fishing locality and the late timing of this terminal stock.

For the Nitinat fisheries (Area 21) all samples were randomly collected from packers immediately after each fishery at processing plants in Vancouver. Commercial gillnet fisheries occurred during September 17-21 and 24-24 where a total of 402 samples were collected. In addition, three test fish samples (approximately 200 each) were obtained in mid October. A total of 1,006 samples were collected from various commercial and test fisheries.

Analysis

After collection, the frozen chum tissues were sent to a contract laboratory for protein analysis. The tissues were analyzed for protein variation. The seven loci analyzed and coded are listed using nomenclature described by Shaklee et al. 1990: IDH-1 (1.1.1.42); PGDH (1.1.1.44); ME (1.1.1.39); G3PDH (1.1.1.8); IDH-3 (1.1.1.42); MPI (5.3.1.8); and Pep (3.4.-.-,) leucyl glycyl glycine substrate. This information was coded and returned to DFO for comparison to appropriate baseline samples. The comparisons and analysis employed the method described by Fournier et al. (1984). Stock composition was estimated using the genotypic frequencies and allocation method outlined by Beacham et al. (1987). The standard deviations of the estimates were determined by boot strapping, where new samples were constructed by sampling the original mixture and baseline with replacement.

In addition, processing checks were conducted by resubmission of a previous sample. These scores and results were then compared to original processed results.

RESULTS

The GSI (electrophoretic) stock composition results from four commercial fishery locations are presented in Tables 1 to 4.

The results of GSI analysis are expressed as percentages by major stock areas (Fraser River; Johnstone Strait/Strait of Georgia; United States; and West Coast Vancouver Island). Included with stock composition estimates are, week and area of collection, sample date and size, gear type sample from, and estimates of standard deviation.

Results of the processing check sample (n=200) revealed 0.9% of the individual scores were different from the original scores. Stock composition results from reanalysis are present in Table 2.

ACKNOWLEDGEMENTS

Senior management technicians J. Mitchell and A. Stefanson coordinated sampling and test fishing. Samples were collected by; T. Cone, S.C. Di Novo, A. Dunlop, L. Naylor, D. Ritchie, J. Quinn, V. Quinn and V. Walker. Skippers of chartered vessels include S. Beans, J. Malatestenic, L. Morris, A. Sorenson and "Moon" Stauffer. A. Sewid coordinated the Mid Vancouver Island sampling. Sample processing comparison was provide by S.C. Di Novo. Protein analysis was by provided Aqua Life Diagnostics and commercial sampling was assisted by J.A. Thomas Ltd.

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Table 1. Weekly stock composition in Johnstone Strait (Area 12 pooled) seine test fishery, 1990 (1).

Week	Sample Date	Sample Size	Gear	STOCK COMPOSITION					
				FR		JS,GS		U.S.	
				%	(1SD)	%	(1SD)	%	(1SD)
9/1	Sep 5- 7	150	TS	18.4	(11.9)	81.6	(11.8)	0.0	(1.2)
9/2	Sep 10-14	300	TS	13.5	(10.4)	76.2	(9.8)	10.4	(5.4)
9/3	Sep 21-23	300	TS	41.5	(12.0)	56.0	(12.2)	2.5	(3.6)
9/4	Sep 25-29	300	TS	47.3	(13.3)	50.7	(12.8)	2.0	(2.9)
10/1	Sep 30- 6	309	TS	36.9	(11.4)	58.8	(12.1)	4.3	(5.6)
10/2	Oct 7-13	311	TS	20.3	(11.0)	77.3	(12.4)	2.4	(5.6)
10/3	Oct 14-20	271	TS	39.0	(14.9)	61.0	(14.7)	0.1	(3.8)
10/4	Oct 24-28	295	TS	14.7	(9.8)	79.5	(10.5)	5.8	(5.8)
10/5	Oct 29- 2	301	TS	14.0	(12.8)	74.1	(12.0)	11.9	(5.5)

(1) % = Point estimate; (1SD) = Standard deviation
Gear : GN - Commercial gillnet; SN - Commercial seine; TS - Test seine.
Area : FR - Fraser River; JS,GS - Johnstone Strait, Strait of Georgia; U.S. - Washington State.

Table 2. Stock composition of Johnstone Strait (Area 12 & 13) commercial seine fisheries, 1990 (1).

Week	Sample Date	Area	Sample Size	STOCK COMPOSITION					
				FR		JS,GS		U.S.	
				%	(1SD)	%	(1SD)	%	(1SD)
9/3	Sep 20	A12/13	199	78.2	(16.0)	21.7	(14.7)	0.1	(6.4)
9/3	Sep 20	A12/13	200	21.7	(13.9)	68.6	(14.5)	9.7	(6.3)
9/3	Sep 20	A12/13	198	81.6	(15.7)	16.5	(15.6)	1.9	(4.5)
9/3	Sep 20 (2)	A12/13	301	47.5	(14.1)	41.6	(14.2)	10.9	(7.6)
9/3	Sep 20 (2)	A12/13	301	36.0	(15.0)	50.6	(13.9)	13.4	(7.3)
9/3	Sep 20	A 12	200	34.0	(13.9)	53.0	(14.0)	13.0	(9.1)
9/3	Sep 20	A 13	202	55.3	(17.8)	38.1	(14.3)	6.6	(7.0)
10/2	Oct 11 (3)	A12/13	200	33.1	(12.4)	51.6	(13.1)	15.3	(8.3)
10/2	Oct 11	A12/13	200	51.0	(15.5)	41.7	(16.7)	7.4	(5.3)
10/2	Oct 11	A12/13	198	65.8	(19.2)	34.1	(18.0)	0.1	(5.2)
10/4	Oct 22	A12/13	201	20.2	(11.7)	67.5	(10.1)	12.4	(5.0)
10/4	Oct 22	A12/13	200	19.9	(15.7)	70.7	(13.7)	9.4	(7.1)
10/4	Oct 22	A12/13	200	31.2	(16.1)	62.7	(14.4)	6.1	(6.9)
9/3	Sep 20 (4)	A12/13	999	51.2	(11.1)	39.0	(10.7)	10.3	(4.2)
10/2	Oct 11 (4)	A12/13	598	53.6	(8.7)	40.5	(8.6)	5.9	(5.1)
10/4	Oct 22 (4)	A12/13	601	23.7	(11.3)	65.1	(10.7)	11.3	(4.7)
10/2	Oct 11 (5)	control	200	27.1	(12.3)	53.2	(13.2)	19.7	(8.0)

(1) % = Point estimate; (1SD) = Standard deviation.
Gear : GN - Commercial gillnet; SN - Commercial seine; TS - Test seine.
Area : FR - Fraser River; JS,GS - Johnstone Strait, Strait of Georgia; U.S. - Washington State.
(2) sample pre mixed from Area 12 and 13 exclusive samples.
(3) original sample used in control comparison.
(4) total sample collected from each fishery.
(5) control sample (samples with insufficent muscle tissue for re processing retain original scores.

Table 3. Stock composition of Mid Vancouver Island (Area 14) commercial gillnet fishery, 1990 (1).

Week	Sub Areas Sampled	Sample Dates	Sample Size	STOCK COMPOSITION FR %	FR (1SD)	JS,GS %	JS,GS (1SD)	U.S. %	U.S. (1SD)
10/3	14-5 Outside	Oct 16-17	150	20.9	(15.8)	73.8	(16.2)	5.3	(5.8)
10/3	14-4,5 Inside	Oct 16-17	151	10.6	(9.9)	89.4	(10.2)	0.1	(4.3)
10/3	14-9 Comox	Oct 16-17	150	0.0	(5.0)	100.0	(5.0)	0.0	(0.2)
10/4	14-5 Outside	Oct 23-24	149	16.7	(14.4)	83.3	(14.6)	0.0	(1.8)
10/4	14-4,5 Inside	Oct 23-24	151	0.1	(10.6)	95.8	(12.5)	4.1	(6.6)
10/4	14-9 Comox	Oct 23-24	150	4.2	(8.3)	95.8	(8.6)	0.0	(1.4)
10/5	14-5 Outside	Oct 30-31	150	43.2	(17.3)	49.2	(16.8)	7.6	(5.3)
10/5	14-4,5 Inside	Oct 30-31	130	0.0	(8.4)	86.6	(8.7)	13.3	(6.9)
10/5	14-9 Comox	Oct 30-31	150	5.6	(11.4)	84.1	(11.1)	10.3	(5.9)

(1) % = Point Estimate; (1SD) = Standard deviation
Gear : GN - Commercial gillnet; SN - Commercial seine; TS - Test seine
Area : FR - Fraser River; JS,GS - Johnstone Strait, Strait of Georgia; U.S. - Washington State.
Sub areas : 14-5 = outside eastern boundary; 14-4,5 = inside western boundary; 14-9 = upper northern boundary.

Table 4. Stock composition of Cowichan (Area 18), commercial gillnet fishery, 1990 (1).

Week	Area Sampled	Sample Dates	Sample Size	STOCK COMPOSITION					
				FR		JS,GS		U.S.	
				%	(1SD)	%	(1SD)	%	(1SD)
11/1	Area 18	Nov 5- 7	126	23.1	(14.8)	76.8	(15.8)	0.1	(6.2)
11/2	Area 18	Nov 12-13		No Sample					
11/4	Area 18	Nov 26-29		No Sample					

(1) % = Point estimate; (1SD) = Standard deviation.
Gear : GN - Commercial gillnet; SN - Commercial seine; TS - Test seine.
Area : FR - Fraser River; JS,GS - Johnstone Strait, Strait of Georgia; U.S. - Washington State.

Table 5. Stock Composition of Nitinat (Area 21) commercial gillnet and test fisheries, 1990 (1).

Week	Sample Date	Sample Size	Gear	STOCK COMPOSITION							
				FR		JS,GS		U.S.		WCVI	
				%	(1SD)	%	(1SD)	%	(1SD)	%	(1SD)
9/3	Sep 17-21	202	GN	21.9	(9.9)	0.3	(5.8)	22.7	(8.1)	55.2	(9.2)
9/4	Sep 24-26	200	GN	6.7	(6.7)	7.7	(7.4)	5.3	(5.3)	80.3	(9.5)
10/3	Oct 15	200	TS	0.1	(2.5)	6.9	(7.2)	0.1	(1.1)	92.8	(7.4)
10/3	Oct 16	201	TS	0.1	(3.8)	12.0	(7.0)	5.5	(4.0)	82.5	(9.0)
10/3	Oct 16	203	TS	0.0	(3.7)	4.8	(6.2)	0.0	(0.8)	95.2	(7.4)

(1) % = Point estimate; (1SD) = Standard deviation.
Gear : GN - Commercial gillnet; SN - Commercial seine; TS - Test seine.
Area : FR - Fraser River; JS,GS - Johnstone Strait, Strait of Georgia; U.S. - Washington State; WCVI - West Coast Vancouver Island.

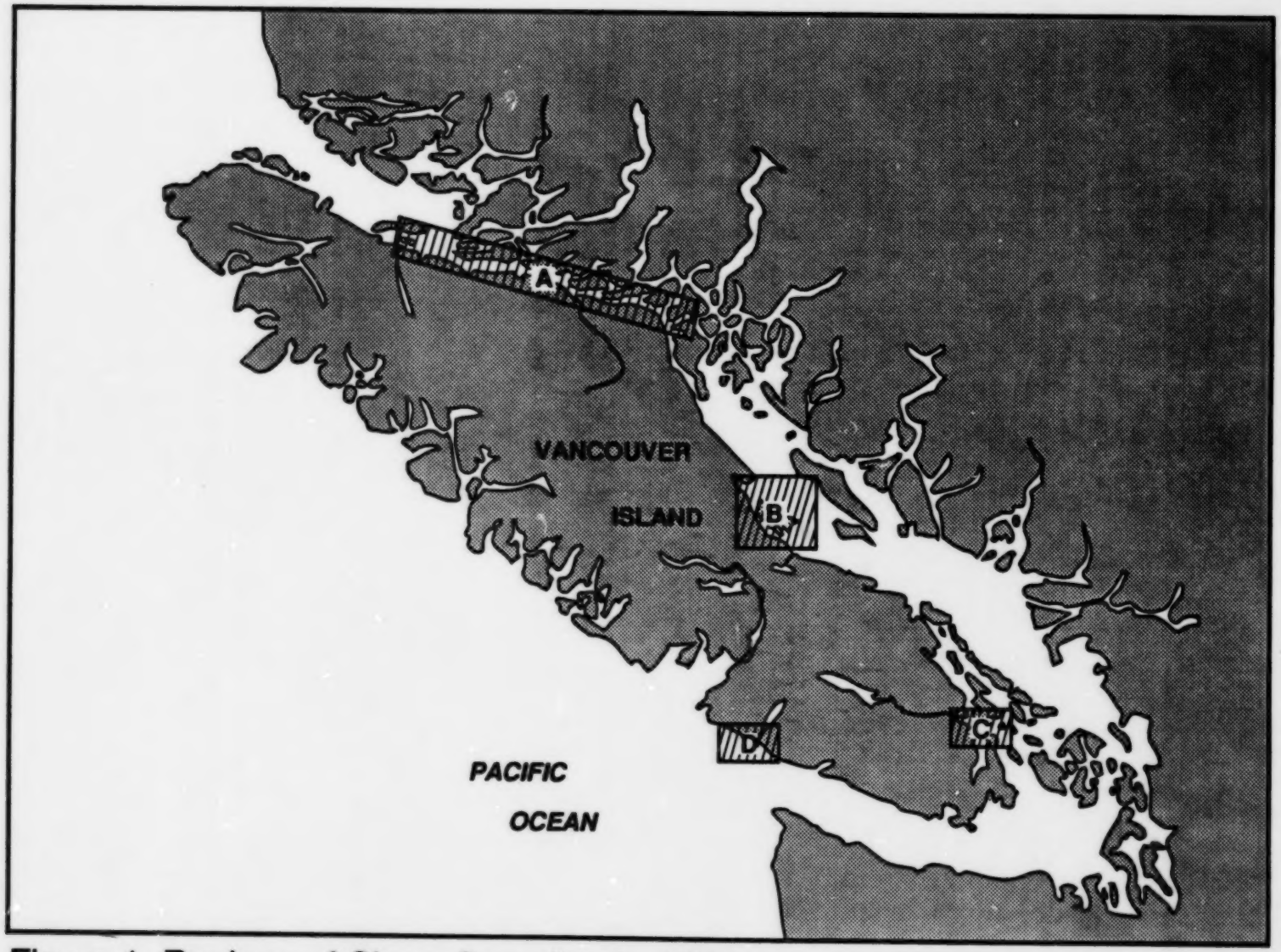

Figure 1. Regions of Chum Sampling in 1990.

(A) Johnstone Strait (B) Mid Vancouver Island (C) Cowichan (D) Nitnat